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Claims

[c1] 1.A thermomechanical process for hot rolling high-strength low-alloy steel made by compact strip production into a thin slab, the process comprising:
deforming the thin slab at least at one roll stand in the full recrystallization region of austenite in the steel; and next deforming the thin slab at least at one roll stand in the region below the recrystallization stop temperature of the austenite in the steel.

[c2] 2.The thermomechanical process of claim 1, wherein deforming the thin slab at least at one roll stand in the full recrystallization region comprises deforming the thin slab at first and second roll stands, and deforming the thin slab at least at one roll stand in the region below the recrystallization stop temperature comprises deforming the thin slab at a third roll stand.

[c3] 3.The thermomechanical process of claim 2, wherein the interpass time from exit of the thin slab from the second roll stand to entry of the third roll stand is greater than the interpass time from exit of the thin slab from the first roll stand to the entry of the second roll stand.

[c4] 4.The thermomechanical process of claim 2, wherein deforming the thin slab at first and second roll stands comprises deforming the thin slab at least approximately -0.60 at each stand, expressed in true reduction strain.

[c5] 5.The thermomechanical process of claim 2, wherein deforming the thin slab at first and second roll stands comprises deforming the thin slab at least approximately -1.39, expressed in cumulative true reduction strain.

[c6] 6.The thermomechanical process as recited in claim 1, wherein the steel has a composition comprising: $0.01 \leq C \leq 0.20$; $0.5 \leq Mn \leq 3.0$; $0.005 \leq N \leq 0.03$; $0 \leq S \leq 0.1$; $0 \leq Al \leq 2.0$; $0 \leq Si \leq 2.0$; $0 \leq Cr \leq 2.0$; $0 \leq Mo \leq 1.0$; $0 \leq Cu \leq 3.0$; $0 \leq Ni \leq 1.5$; $0 \leq B \leq 0.1$; $0 \leq P \leq 0.5$; and at least one element selected from the group consisting of $0 \leq Nb \leq 0.2$; $0 \leq Ti \leq 0.12$; and $0 \leq V \leq 0.15$, with the balance being iron and incidental impurities.

[c7] 7.The thermomechanical process of claim 1, wherein deforming the thin slab at least at one roll stand in the full recrystallization region comprises deforming the thin slab at first, second, and third roll stands, and deforming the thin slab at least at one roll stand in the region below the recrystallization stop temperature comprises deforming the thin slab at a fourth roll stand.

[c8] 8.The thermomechanical process of claim 7, wherein the interpass time from exit of the thin slab from the third roll stand to entry of the fourth roll stand is greater than the interpass time from exit of the thin slab from the second roll stand to the entry of the third roll stand.

[c9] 9.The thermomechanical process of claim 7, wherein deforming the thin slab at first, second, and third roll stands comprises deforming the thin slab at least approximately -1.39, expressed in cumulative true reduction strain.

[c10] 10.The thermomechanical process of claim 1, wherein deforming the thin slab at least at one roll stand in the full recrystallization region comprises deforming the thin slab at first, second, third, and fourth roll stands and deforming the thin slab at least at one roll stand in the region below the recrystallization stop temperature comprises deforming the thin slab at a fifth roll stand.

[c11] 11.The thermomechanical process of claim 10, wherein the interpass time from exit of the thin slab from the fourth roll stand to entry of the fifth roll stand is greater than the interpass time from exit of the thin slab from the third roll stand to the entry of the fourth roll stand.

[c12] 12.The thermomechanical process of claim 10, wherein

deforming the thin slab at first, second, third, and fourth roll stands comprises deforming the thin slab at least approximately -1.39, expressed in cumulative true reduction strain.

[c13] 13.The thermomechanical process of claim 1, wherein deforming the thin slab at least at one roll stand in the full recrystallization region comprises deforming the thin slab at first, second, third, fourth, and fifth roll stands and deforming the thin slab at least at one roll stand in the region below the recrystallization stop temperature comprises deforming the thin slab at a sixth roll stand.

[c14] 14.The thermomechanical process of claim 13, wherein the interpass time from exit of the thin slab from the fifth roll stand to entry of the sixth roll stand is greater than the interpass time from exit of the thin slab from the fourth roll stand to the entry of the fifth roll stand.

[c15] 15.The thermomechanical process of claim 13, wherein deforming the thin slab at first, second, third, fourth, and fifth roll stands comprises deforming the thin slab at least approximately -1.39, expressed in cumulative true reduction strain.

[c16] 16.The thermomechanical process of claim 1, wherein deforming the thin slab at least at one roll stand in the

full recrystallization region comprises deforming the thin slab at first, second, third, fourth, fifth, and sixth roll stands and deforming the thin slab at least at one roll stand in the region below the recrystallization stop temperature comprises deforming the thin slab at a seventh roll stand.

[c17] 17.The thermomechanical process of claim 16, wherein the interpass time from exit of the thin slab from the sixth roll stand to entry of the seventh roll stand is greater than the interpass time from exit of the thin slab from the fifth roll stand to the entry of the sixth roll stand.

[c18] 18.The thermomechanical process of claim 16, wherein deforming the thin slab at first, second, third, fourth, fifth, and sixth roll stands comprises deforming the thin slab at least approximately -1.39, expressed in cumulative true reduction strain.

[c19] 19.A thermomechanical process for hot rolling high-strength low-alloy steel made by compact strip production into a thin slab, the process comprising:
deforming the thin slab at from two to four initial roll stands at least approximately -1.39, expressed in cumulative true reduction strain, in the full recrystallization region of austenite in the steel;

allowing adequate time to pass to permit static recrystallization of the austenite in the steel prior to additional deformation; and
deforming the thin slab at up to four final roll stands in the region below the recrystallization stop temperature of the austenite in the steel.

[c20] 20.A thermomechanical process for hot rolling high-strength low-alloy steel made by compact strip production into a thin slab, the process comprising:
rolling thin slab cast steel through initial, central, and final roll stands; and
deforming the thin slab only at the initial roll stand or roll stands in the full recrystallization region of austenite in the steel and at the final roll stand or roll stands in the region below the recrystallization stop temperature of the austenite in the steel, omitting deformation at least at one selected central strand.

[c21] 21.A thermomechanical process as recited in claim 20, wherein the interpass time between roll stands adjacent to the central roll stand or roll stands where no deformation occurs is greater than the interpass time between the immediately preceding two roll stands.

[c22] 22.A deformation process for hot rolling high-strength low-alloy steel made by compact strip product into a

thin slab, the deformation process consisting of:
deforming the thin slab in the full recrystallization region of austenite in the steel; and
subsequently deforming the thin slab in the region below the recrystallization stop temperature of the austenite in the steel.

[c23] 23.The deformation process of claim 22, wherein deforming the thin slab in the full recrystallization region comprises deforming the thin slab at first and second roll stands, and deforming the thin slab in the region below the recrystallization stop temperature comprises deforming the thin slab at least at a third roll stand.

[c24] 24.The deformation process of claim 23, wherein the interpass time from exit of the thin slab from the second roll stand to entry of the third roll stand is greater than the interpass time from exit of the thin slab from the first roll stand to the entry of the second roll stand.

[c25] 25.The deformation process of claim 23, wherein deforming the thin slab at the first and second roll stands comprises deforming the thin slab at least approximately -0.60 at each stand, expressed in true reduction strain.

[c26] 26.The deformation process of claim 22, wherein the steel has a composition comprising: $0.01 \le C \le 0.20$;

$0.5 \leq Mn \leq 3.0$; $0.005 \leq N \leq 0.03$; $0 \leq S \leq 0.1$; $0 \leq Al \leq 2.0$; $0 \leq Si \leq 2.0$; $0 \leq Cr \leq 2.0$; $0 \leq Mo \leq 1.0$; $0 \leq Cu \leq 3.0$; $0 \leq Ni \leq 1.5$; $0 \leq B \leq 0.1$; $0 \leq P \leq 0.5$; and at least one element selected from the group consisting of $0 \leq Nb \leq 0.2$; $0 \leq Ti \leq 0.12$; and $0 \leq V \leq 0.15$, with the balance being iron and incidental impurities.

[c27] 27.A thermomechanical process for making high-strength low-alloy steel by compact strip production, the process comprising:
adding at least one microalloying element to a molten steel;
continuously casting the molten steel as a thin slab with an approximate thickness of from 25 mm to 100 mm;
thermally equilibrating the thin slab to a temperature suitable for hot rolling in the full recrystallization region of austenite in the steel;
deforming the thin slab at from two to four initial roll stands at least approximately -1.39, expressed in cumulative true reduction strain, in the full recrystallization region of the austenite in the steel; and
next deforming the thin slab at up to four final roll stands in the region below the recrystallization stop temperature of the austenite in the steel.